Stability Improvement of the Active Grating Monochromator at NSRRC

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Abstract

Angle stability of the active grating monochromator (AGM) system is essential to achieve the ultra-high resolution in the inelastic scattering beamline at NSRRC. In this report, the upgrade of the AGM is described. The grating holder is vibration isolated from the chamber by vacuum bellows. The supporting base of the chamber and grating is fixed on a common granite base, which is seated on a flat steel plate glued to ground. The angle stability of the grating is measured by the autocollimator. The performance of grating scanning mechanism is also measured.

Design consideration for mechanical stability

(a) Stable grating mounts, adjustments and scan mechanism.
(b) Indirect water cooling for the grating via copper braid.
(c) Cylindrical chamber in vertical mount.
(d) Granite base and flat steel plate glued to the floor.

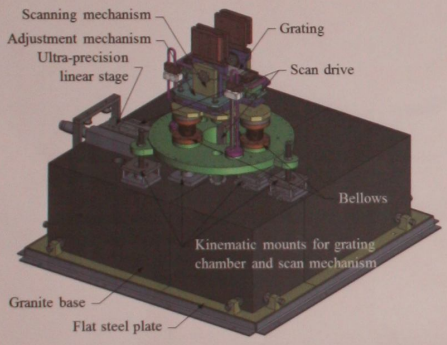
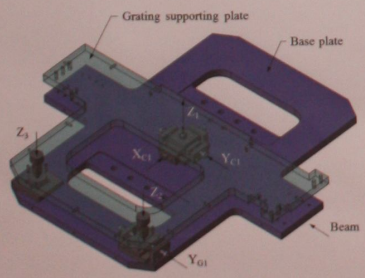


Figure 1. Grating and bender, adjustment mechanism, scan drive, water cooling, ultra-precise linear stage, bottom flange and granite base assemblies.

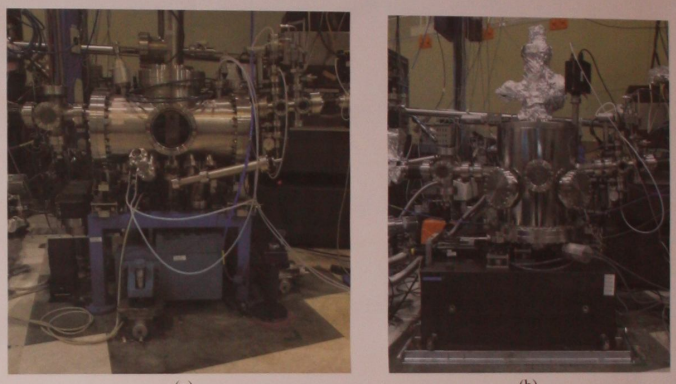


Direction	Direction of adjustment
X	X_{C1}
Y	Y_{C1} and Y_{G1}
Z	Z_1, Z_2 and Z_3 synchronized
Pitch	Z_2 and Z_3 reverse
Roll	Z_2 and Z_3 synchronized
Yaw	Y_{G1}

Adjustment resolution:
X= 7μm , Y= 7μm , Z= 10μm, Pitch= 0.27μrad, Roll= 1.47μrad, Yaw= 4.11μrad

Figure 2. Fine adjustment mechanism of the grating in *X*, *Y*, *Z*, pitch, roll and yaw

Figure 3. Water cooling for the grating with a flexible thermal link is made with a swaging method.



(a) (b)

Figure 4. AGM system (a) old system, (b) new system.

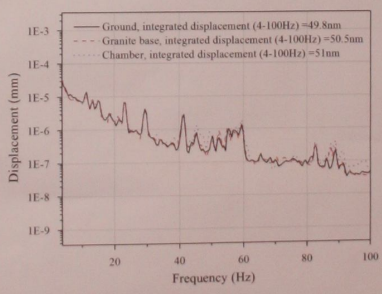


Figure 5. Comparison of vertical displacement on ground, granite base and chamber.

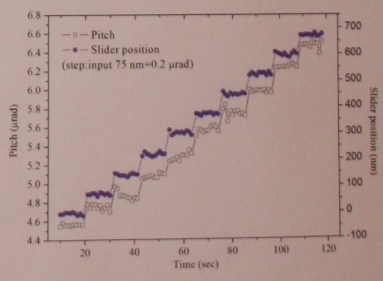


Figure 6. Angle resolution of the scan mechanism reach 0.2μrad.

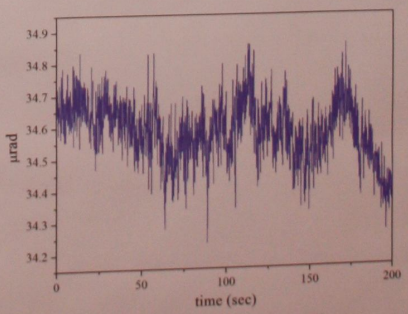


Figure 7. Angular stability of the new AGM systems with an autocollimator.

Achieved Result

- All components are mounted on a special designed CF 22" bottom flange. It is convenient for the installation and alignment of the grating before the chamber installation.
- The angular resolution of the grating scan mechanism in the pitch direction is 0.2μrad.
- The angular stability of the improved AGM system is about 0.6μrad rms.